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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 3, 2016/2017

**EEM1016 – ENGINEERING MATHEMATICS I**  
( All sections / Groups )

02 JUNE 2017  
3.00 p.m - 5.00 p.m  
( 2 Hours )

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### INSTRUCTION TO STUDENT

1. This Question paper consists of 4 pages (including cover page) with 4 Questions only.
2. Attempt ALL questions. The distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

**Question 1(25 marks)**

(a) Find the following limits:

(i)  $\lim_{x \rightarrow +\infty} \frac{6x-5}{2+e^{3x}}$  [3 marks]

(ii)  $\lim_{x \rightarrow 5} \frac{x^2 - 2x - 15}{x^2 - 7x + 10}$  [3 marks]

(b) Find  $\int x^2 \ln x \, dx$  [4 marks]

(c) Let  $f(x) = x^3 - 4x^2 - 9x - 4$  in the closed interval  $[-1, 4]$ .

(i) Identify the critical points of  $f(x)$ . [3 marks]

(ii) Hence, find the absolute extreme values of the function. [4 marks]

(d) If the radius increases from 1.00m to 1.02m and the height decreases from 1.00m to 0.98m of a closed cylinder, determine the approximate change of each (i) and (ii) by using the differentials. (Leave your answer in  $\pi$  form)

(i) surface area [5 marks]

(ii) volume [3 marks]

**Question 2(25 marks)**

(a) (i) Find the real values of  $x$  and  $y$  if  $(x - iy)(2 + 3i) = 6 - i$  [5 marks]

(ii) Let  $w = \frac{1}{2} + \frac{1}{2}i$ . Use De Moivre's theorem to find all the cubic roots of  $w$  by solving the equation  $z^3 = w$ . [7 marks]

Continued...

- (b) (i) Find the vector and parametric equations for the line passing through  $P(1,2,1)$  and perpendicular to the plane:  $3x - 7y + 5z = 14$ . [5 marks]
- (ii) Find an equation for the plane passing through the point  $A(-2,1,3)$ ,  $B(-1,-3,1)$  and  $C(-3,2,-4)$ . [6 marks]
- (iii) Given  $\hat{v} = 2i + j$  and  $\hat{u} = 2i + 2j + 3k$ . Find  $\hat{u} \cdot \hat{v}$ . [2 marks]

**Question 3(25 marks)**

- (a) (i) Let  $f(x) = \cos x + \sin^2 x$ . Is the function  $f$  odd, even or neither odd nor even? Give your justification. [5 marks]
- (ii) Let  $g(x) = \sin 4x$  and  $h(x) = \sin x + \cos \frac{x}{2}$ . Find the periods of  $g$  and  $h$ . [5 marks]

- (b) A  $2\pi$  period odd function  $f$  is defined by

$$f(x) = \begin{cases} -1 & -\pi < x < 0, \\ 1 & 0 < x < \pi. \end{cases}$$

- (i) Sketch the graph of  $f$  for  $-3\pi < x < 3\pi$ . [5 marks]
- (ii) Find the Fourier series of  $f$ . [10 marks]

Continued...

**Question 4(25 marks)**

(a) List the first three terms of the following sequence:

(i)  $\left\{ \frac{4n}{n^2 - 7} \right\}_{n=0}^{\infty}$  [3 marks]

(ii)  $\left\{ \frac{(-1)^{n+1}}{2n + (-3)^n} \right\}_{n=2}^{\infty}$  [3 marks]

(b) Determine if the given sequence converges or diverges. If it converges, determine its limit.

(i)  $\left\{ \frac{n^2 - 7n + 3}{1 + 10n - 4n^2} \right\}_{n=3}^{\infty}$  [3 marks]

(ii)  $\left\{ \frac{(-1)^{n-2} n^2}{4 + n^3} \right\}_{n=0}^{\infty}$  [3 marks]

(iii)  $\left\{ \frac{e^{5n}}{3 - e^{2n}} \right\}_{n=1}^{\infty}$  [3 marks]

(c) Determine the interval and radius of convergence for the following power series.

$$\sum_{n=0}^{\infty} \frac{1}{(-3)^{2+n}(n^2 + 1)} (4x - 12)^n$$
 [10 marks]

**End of Paper**